MANUFACTURING EQUIPMENT DIAGNOSIS SUPPORT SYSTEM

FIELD

[0001] The present invention relates to a manufacturing equipment diagnosis support system which predicts abnormality and/or a malfunction beforehand, in a manufacturing equipment such as a rolling mill which rolls a metal material with rolls and a machining center which performs machining.

BACKGROUND

[0002] There exists a lot of manufacturing equipment as a social infrastructure. The rolling mill and the machining center are examples of the manufacturing equipment. The rolling mill is equipment for rolling and thinning a block of a ferrous material or a non-ferrous material such as aluminum and copper, and thereby facilitating the metal material to be worked into vehicles and electrical products. The machining center is equipment for machining, for instance, steel plates to manufacture airplanes, automobiles, various dies and the like.

[0003] The manufacturing equipment is strongly required to manufacture a product stably and at high speed. For this reason, in order to avoid production inhibition due to a failure of the manufacturing equipment, a technology for predicting abnormality and/or a malfunction in the manufacturing equipment beforehand has been progressively developed. Recently, a technology is advancing which picks up significant information from among a large amount of data, such as data mining and big data analysis. In these technologies, such a process is also performed as to submit data to processing which uses a forcible technique of using a high-speed large-capacity calculator, calculate features of data, and extract a relationship between the data. Prior art documents which describe the specific contents include the following patent literatures, for instance.

[0004] PTL 1 discloses a technology for finding out regularity between the data when there are a plurality of data. This technology is a technology of dividing the data into certain sections, calculating a feature in the section, classifying the features, and giving a label value to the features thereby to find out the regularity. However, this technology is not a technology particularly of targeting manufacturing equipment, but is a proposal of a general method.

[0005] A technology disclosed in PTL 2 is a technology of extracting a feature of data by using a statistical technique such as wavelet transformation and a principle component analysis, finding out similarity to failure data stored in the past, and determining the abnormality. This technology also does not target the manufacturing equipment, in particular, but is a proposal of a general method.

[0006] A technology disclosed in PTL 3 is a technology of determining similarity between a past normal example and an abnormal example with reference to the examples, and determining whether there is abnormality or not in the plant or the equipment, similarly to the technology disclosed in PTL 2.

CITATION LIST

Patent Literature

[0007] [PTL 1] JP 2006-338373 A
[0008] [PTL 2] JP 2006-106870 A
[0009] [PTL 3] JP 2010-191556 A

SUMMARY

Technical Problem

[0010] The technology disclosed in PTL 1 does not use prior knowledge (for instance, correlation between data, and the like) which exists in object data, and tries to find out regularity only within the object data. Then, it is anticipated that the calculation processing takes many time periods. In addition, when noise and unknown disturbance are included in the data, there is a concern that the extraction of the regularity becomes unstable.

[0011] The technologies disclosed in PTL 2 and PTL 3 are characterized in that the technologies use past knowledge concerning abnormality and/or malfunction. However, of course, the past knowledge is useful, but cannot be applied without prior knowledge that the abnormality and/or the malfunction have occurred in the past, and the technologies cannot cope with the new abnormality and/or the malfunction which has never occurred.

[0012] In contrast to these conventional technologies, the manufacturing equipment diagnosis support system which the present invention provides compares data of a plurality of similar apparatuses which are arranged in manufacturing equipment or data of a plurality of similar apparatuses which are dispersedly arranged in a plurality of sets of manufacturing equipment, to each another, and thereby can easily detect the abnormality and/or the malfunction of the apparatus without needing enormous calculation processing for finding out the regularity and also without needing the past knowledge.

Solution to Problem

[0013] A manufacturing equipment diagnosis support system according to the present invention includes a data collecting device which always or intermittently collects and records respective data in a plurality of apparatuses to be monitored that are arranged in manufacturing equipment, or in a plurality of apparatuses to be monitored that are dispersedly arranged in a plurality of sets of manufacturing equipment. The manufacturing equipment diagnosis support system according to the present invention also includes a data analysis device which analyzes the data that has been recorded in the data collecting device, and a display device which displays an analysis process and an analysis result of the data analysis device. The data analysis device includes data analysis range setting means, data grouping means, feature extracting means, unusual phenomenon specifying means, and testing means.

[0014] The data analysis range setting means is configured so as to set a range of analysis of data which has been recorded in the data collecting device, by a data item and a time period.

[0015] The data grouping means is configured so as to input data existing in the range which has been set by the data analysis range setting means from the data collecting device; classify each of the data into a category based on specification and use condition of the apparatus to be monitored from which the data has been collected, and a category based on a physical quantity which the data shows; and thereby group the data which the data grouping means has inputted from the data collecting device. The data